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Modelling a Regional Economic System: The Case of Lombardy

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MODELLING A REGIONAL ECONOMIC SYSTEM:THE CASE OF LOMBARDY

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MODELLING A REGIONAL ECONOMIC SYSTEM: THE CASE OF LOMBARDY[§]

By

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Abstract: During recent years the demand for quantitative economic investigation to be used for policy analysis has grown rapidly. In addition, the European economic and monetary integration process has increased the economic impact of regional economies, thus calling for analytical instruments aimed at supporting the decision-making process. We set up a regional econometric model of Lombardy's labour market, in which both labour demand and supply are endogenously determined and thus unemployment is determined by their interaction. Therefore, we model labour demand in the industrial sector and in private services, while labour supply is split into two components which define respectively the participation rate and self employment. The model simulations evaluate the response of the regional labour market, in comparison with the national one, to exogenous shocks depending on shocks in either demand or supply. The intersectoral difference highlights the fact that industry, although declining in terms of employment, still maintains a crucial role in generating employment multiplier effects, which in turn may reduce unemployment. This evidence has important policy implications, as it suggests that industrial policy may play a crucial role in stimulating labour demand and supply, and through this route the whole regional growth process.

JEL Classification: E17, R23

Key words: Regional econometric models, Simulation, Labour demand, Labour supply

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1. Introduction

The use of macroeconometric models for policy analysis has been implemented during recent decades with wavering fortune. In the sixties and early seventies macreoeconometric models were an important tool used to represent alternative scenarios and then draw conclusions leading to policy suggestions. However, since Lucas's critique they have partially lost their appeal as a policy tool, though the development of econometric analysis has permitted the incorporation of rational expectations within such models. Macroeconometrics is still an important tool used by central banks (BANK of ITALY (1986)), government research units (FIORITO et.al. (2000)) and international organisations (IMF (1998), European Commission, ROEGER (1997)).

Following the wavering fortune of aggregate national models, regional econometric models received considerable attention in the '70s and '80s, while since then they have been partially abandoned. The seminal works by ADAMS, BROOKING and GLICKMAN (1974) and GLICKMAN (1977) represent clear and excellent examples of the application of macroeconometric modelling to regional economic systems.

Typically, these earlier approaches followed the tradition of the larger national econometric models, in that they represented the application to a small open economy of a Keynesian (IS-LM type) general equilibrium model.

In addition, the inclusion of wage equations permits the inclusion of wage determination and the unemployment rate into such modelling strategies. An excellent review of the philosophy and structure of these approaches is provided by BOLTON (1986). As we have previously mentioned, more recent economic and econometric developments have emphasised the role of supply side economic factors and the role of the

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adjustment process of economic variables towards their equilibrium level. This latter point has been stimulated by the application of cointegration and error correction representation models.

In more recent years however, regional modelling has also gained from important insights derived from new theoretical and empirical issues, in particular from the new growth theory and the underlying convergence controversy.

FINGLETON (2001) and FREEMAN (2001) represent two example of this development. The former investigates the dynamics of European regional convergence, by using a spatial econometric approach and simulations which try to incorporate the suggestions made by FUJITA, KRUGMAN and VENABLE (1999) on the need for a computable geographic equilibrium model. The latter considers the role of employment and population in the US regional growth process by using panel cointegration techniques and causality tests, which permit him to ascertain the relative role of demand-side (export driven) or supply-side (regional amenities) explanations of the regional growth process.

Our modelling strategy tries to fill the gap between traditional regional models, on the one hand, and supply side and economic dynamic issues, on the other.

We propose a labour market model of Lombardy, which is one of the most economically advanced regions within Italy and the European Union. We extend such a model to the national economy and compare the results of policy simulation, which then enables us to define the characteristics of the regional economy more precisely. This approach follows a previous study (BAUSSOLA and FIORITO, 1994) in which the three macro areas (North, Centre and South) characterising the Italian economy are modelled within a macroeconometric framework based on a seminal work by FIORITO (1984). In this paper we extend such an analysis and focus on labour demand and supply, which are both endogenously determined. This characteristic of the model highlights the difference from other approaches to labour market modelling, in which the labour force is taken as exogenous (MODIGLIANI, PADOA SCHIOPPA and ROSSI 1986), thus distorting the effect of demand and supply shocks on unemployment.

As compared with other regional models (e.g., MINFORD, STONEY, RILEY and WEBB (1994)) our approach allows for a more detailed representation of the labour market, as sectoral labour demand (industry and tradable services) is specified together with aggregate labour supply. Thus unemployment is endogenously determined by the

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interactions of labour supply and demand, allowing for an unambiguous analysis of those factors affecting changes in the unemployment rate. Indeed, by analysis of the transmission mechanism underlying the model, one can easily derive the impact of exogenous shocks on unemployment, thus providing significant insights for policy analysis

The aim of our study is to pinpoint the main characteristics and differences between the regional and national labour markets, and thus analyse how labour demand and supply are affected by various demand or supply shocks.

We use a top-down rather than a bottom-up approach, as we are concerned with a comparison of such responses in the national and regional economies. Indeed, the former approach implies that the characteristics of the national and regional economies are reflected by differences in parameters rather than by different specifications. This is a well-known limitation of such an approach which, however, has to be compared with the limitations of the bottom-up approach, which cannot compare models having different specifications.

It is worth underlining that our study makes a significant contribution to the debate on regional performance in the Italian economy, as it offers an analytical tool which helps explain the sources of regional disparities (e.g., unemployment rate differentials between regions) and thus to highlight policy options.

The majority of literature on the performance of the Italian regional economy has focused mainly on convergence issues, rather than on modelling strategies. In addition, labour market studies are based mainly on individual data (either individuals or firms) while few studies have used regional aggregate data.

Among these, BODO, D'ALESSIO AND SIGNORINI (1993) use a principal component and then a cluster analysis approach to highlight regional inequalities in the Italian labour market between the '70s and the early '90s. A more recent study by Scorcu (2001) analyses the dynamics of the regional unemployment rate and emphasises how structural unemployment has been rising continuously in the Italian labour market.

The paper is organised as follows. In the following section we briefly characterise the growth patterns of Lombardy and Italy over the last 30 years, by focusing on the main macroeconomic indicators. In Section Three we describe the structure of the model, and present the estimates of labour demand and supply at the regional and national levels. In Section Four we simulate the model and discuss the response of the endogenous variables

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to different exogenous shocks. Implications and conclusions are then discussed in Section Five.

2 Regional Growth and the Labour Market

In order to better analyse the labour market model used in the following sections, it is worth recalling the main macroeconomic facts which have characterised the regional and national economy over last 30 years.

INSERT TABLE 1 ABOUT HERE

Looking at per-capita income (GDP/POP), we see that convergence between the regional and the national economy has been week, as the ratio of Lombardy's per capita income to the corresponding Italian value shifts from 1.41 in 1970 to 1.32 in 2000. This means that after 30 years the gap between the regional and national income still remains high, as Lombardy shows an income level which is 32% higher than in Italy as a whole. This gap is smaller (16% in 2000) if we look at value added per worker (GDP/TE); in this case the gap remained steady over the 30 years considered in this analysis. However, if we look at the sectoral breakdown of value added per worker, the gap is still high and persistent in private services. In this sector, value added per employee (VASER/ESER) is more than 3.6 times higher in Lombardy than in Italy as a whole in 1970, and it declines to 2.04 in 2000. The gap in agriculture remains steady over the whole period, implying that value added per worker in agriculture (VAAGR/EAGR) is more than 40% higher in Lombardy than in Italy as a whole.

In terms of growth rate, the regional and national economies show a more convergent pattern; during the first decade per capita value added grows at an average annual rate which is more than 3.3% in Italy as a whole and 2.7% in Lombardy. In the second decade, this growth rate is about 2.3% in Lombardy and 2.7% in Italy, while in the third decade it declined sharply in both contexts, as the annual growth rate drops to an average annual value of 1.1% in Lombardy and 1.25% in Italy as a whole.

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INSERT TABLE 2 ABOUT HERE

If we split each of the three decades into two sub-periods, we have a picture which shows that the more successful periods of growth were between 1976 and 1980 and between 1986 and 1990, while there was a gloomy period between 1991 and 1995, which in turn coincided with the financial crisis of 1992 and the set-up of the Maastricht agenda.

In addition, during these years investment decreased, although this decrease was greater in Italy as a whole, given that fixed investment decreased at an average annual rate of 0.51% in Lombardy and 2.05% in Italy. On the whole, the growth rate of fixed investment in the decade between 1990 and 2000 remains below the threshold of 2% per year in both the regional and national context.

The growth rate of value added per employee is relatively steady and it varies between a maximum of 2.54 % in the first decade and 1.39% in the last decade in Lombardy. In Italy the maximum and minimum are reached in the same periods with corresponding values of respectively 2.82% and 1.43%. The sub-period 1996-2000 confirms a gloomy trend, as value added per worker grew only 1.15% in Lombardy and 0.71% in Italy as a whole.

Not surprisingly, Total Factor Productivity follows the same pattern as income growth, in that it shows a growth rate which is higher in the first decade and then starts declining, particularly during the last sample period. The pattern is moderately differentiated between sectors, revealing that industry has a higher TFP growth rate compared with tradable services. TFP growth rate declines sharply between 1996 and 2000, this being coherent with international comparisons of productivity growth rates, suggesting that the use of information technology has speed up productivity in the US more than it has done in Europe, and therefore in Italy.

The growth rate in nominal labour cost (LC) in industry and services follows a similar pattern in both the regional and national labour markets. The growth rate of product prices, i.e., the deflator in industry and services (DEF), is less than that of labour cost, particularly during the early seventies, as in this period union power increased considerably, thus giving an important push to nominal wages. It is worth noting, however, that the growth rate of inflation as measured by the growth rate of the GDP deflator (DEFGDP) is close to that of nominal labour cost in industry in both frameworks. This is

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not the case in the service sector, where the growth rate of money wages is always higher than that of inflation; in this framework a crucial role may be played by the wage setting rules in sectors like finance and banking, where wages have always been higher than in industry.

Labour market indicators highlight the differences between Lombardy and the rest of the country even more, as the participation rate and the employment rate are significantly higher in the former labour market, and therefore the unemployment rate indicates a better performance in this context.

INSERT TABLE 3 ABOUT HERE

In general it can be seen that the macroeconomic performance of Lombardy is constantly better than that of Italy with respect to income, employment, and unemployment. However, over the last decade and particularly during the period 1996-2000, there has been a significant decrease in some of the economic indexes used to analyse aggregate performance. In particular, a reduction in the TFP growth rate and income growth rate, pose questions as to the ability of even a well-developed region like Lombardy to remain on a stable and higher growth path in the long-run.

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3. The regional labour market model

It is worth highlighting the philosophy and the theoretical background behind the model, before explaining its structure in more detail. We take the goods market as being exogenous, as our aim is to analyse the labour market response to different supply or demand shocks, and to compare such responses at the national and regional levels. Labour demand is derived for the industrial sector and for tradable services, while agriculture, construction and non-tradable services employment is taken exogenous. The exogeneity of sectoral value added, wages and prices can also be justified in terms of model manageability and in order to evaluate the regional response to a variety of shocks.

In our model we consider two components of labour supply. The first reflects the discouraged workers effect (TELLA 1964), in that the participation rate is closely related to the employment rate. The second effect reflects a typical neo-classical argument that labour supply depends on individual choice based on opportunity costs (labour/leisure choice).

Sectoral labour demand is derived by inverting sectoral production functions in manufacturing and tradable services, given the assumption of a profit-maximising representative firm.

The structure of the regional model is defined as follows:

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(1) EEIND(i)) = g_1{VAIND(i), WIND(i), DEFIND(i), LH(i)}

(2) EESER(i) = g_2{VASER(i), WSER(i)/DEFSER(i), LH(i)}

(3) SE(i) = g_3{PROFSE(i), UR(i), YU(i)}

(4) PR(i) = g_4{, SE/POP(i), EE/POP(i), IMMIG(i)}

(5) TE(i) ≡EEIND(i)+EESER(i)+EEAGR(i)+OEE(i)+SE(i)

(6) TEE(i) ≡ α*TE(i)

(7) LF(i) ≡PR(i)*POP(i)

(8) UR(i) ≡(LF(i)-TEE(i))/LF(i)*100

(9) PROF(i) ≡((VAIND(i)*DEFIND(i)+VASER(i)*DEFSER(i)+VAGR(i)*DEFAGR(i))-(WIND(i)*EEIND(i)+WSER(i)*EESER(i)+WAGR(i)*EEAGR(i))-INTAX(i))

(10) PROFSE(i) ≡PROF(i)/SE(i)

(11) EE(i) ≡EEIND(i)+EESER(i)+EEAGR(i)+OEE(i)

Legend:

DEFAGR	**value added deflator in agriculture (1995=100)**
DEFIND	**value added deflator in industry (1995=100)**
DEFSER	**value added deflator in tradable services (1995=100)**
EE	**total employees**
EEAGR	**employees in agriculture**
EEIND	**employees in industry**
EESER	**employees in tradable services**
IMMIG	**immigration flows from abroad**
INTAX	**net indirect taxes**
LF	**labour force**
OEE	**other employees**
PR	**participation rate**
PROF	**nominal total profits**
POP	**population**
SE	**self employment**
TE	**total employment (labour units)**
TEE	**total employment, derived by applying an appropriate coefficient of transformation (calculated by ISTAT) to total labour units**
LH	**labour hoarding, proxied by the ratio of labour productivity to total factor productivity**
UR	**unemployment rate**
VAAGR	**value added in agriculture at 1995 prices**
VAIND	**value added in industry at 1995 prices**
VASER	**value added in tradable services at 1995 prices**
WAGR	**per capita nominal labour cost in agriculture**
WIND	**per capita nominal labour cost in industry**
WSER	**per capita nominal labour cost in tradable services**
YU	**ratio of persons searching a job for the first time to total unemployed**
i	**Lombardy, Italy**

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The model has four stochastic equations, and seven identities. Equations 1) to 2) identify labour demand in industry and private services, and thus we take employment in agriculture as being exogenous[1]. Labour demand depends on value added, factor cost, and a proxy of labour hoarding. This specification implicitly derives from the usual Cobb-Douglas production function, in which output is proxied by value added. Labour demand is therefore obtained by the usual profit maximisation condition, which implies that labour productivity be equal to real wages. If one uses a log transformation of the condition for profit maximisation, one can decompose the labour cost variable (product wage) into nominal wage and product price.

Labour hoarding is captured by the short-run dynamics and by a specific proxy (the ratio of labour to total factor productivity) which, in turn, is a proxy for labour utilisation[2]. The impact of labour hoarding on the employment adjustment process has been widely analysed and it has been used to explain the phenomenon of pro-cyclical productivity[3].

Labour hoarding reflects the intensity with which labour is used over the business cycle. Labour utilisation may be used to measure the extent of labour hoarding, in that the more intensely the labour input is used in the production process, the less hoarding is expected to exist. Many empirical studies on employment and its adjustment process over the business cycle utilise labour productivity as a proxy for labour utilisation and thus for labour hoarding[4].

In our specification, we adopt a relative index of labour productivity, i.e., the ratio of labour to total factor productivity. This measure may indeed capture more precisely the extent to which labour utilisation increases with respect to other production inputs (e.g., capital), than labour productivity alone.

Labour supply is split into two components (equations 3) and 4)).The first is a modified version of the discouraged worker hypothesis. Following this hypothesis, fluctuations in labour supply, as described by fluctuations in the labour force participation rate, are crucially influenced by variations in employment, and thus reflect changes in the demand for labour. Thus a shrinking labour market may discourage labour force participation, while an expanding job market will have the opposite effect. This specification takes into account how different levels of economic

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activity may influence labour demand and supply, and therefore unemployment. In addition, we modify this original version of the discouraged worker by separating employment into two components: self-employment and employees (BAUSSOLA and FIORITO 1994). In our specification the participation rate depends on the ratio of employees to population and the ratio of self-employment to population. In addition we include a migration index to take the effect of migration flows from foreign countries into account[5].

The second component of labour supply is self-employment, and this represents the typical neo-classical version of the supply of labour. Thus we include profits (9) and structural variables (the unemployment rate and the ratio of young unemployed to total unemployed) as explanatory variables to capture the marginal component of workers who eventually decide to set up an independent activity in response to adverse job market opportunities.

Unemployment is endogenously determined (8) by the interaction of the labour force (7) and total employment (6). The former is obtained by applying the participation rate as determined in equation (4), and the latter is the sum of employees in industry, private services, employees in agriculture, other employees and self-employment (5), then transformed into total employment in equation (6).

4. Data description and Estimates

The model described in the previous section has been estimated by using data derived from the Regional Accounts data set available from the Italian National Institute of Statistics (ISTAT 2000).This data set covers only the period 1980-2000, and thus we have matched it with the Regional Accounts data set set-up by SVIMEZ in collaboration with ISTAT (SVIMEZ 1998), and covering the period 1970-1980, in order to have a longer time span available for our estimates[6].

Both data sets refer to NIPA annual data (National Income and Product Accounts) specifically created by ISTAT in order to provide a detailed information set to be used to analyse regional economic performance, and in particular the north-south income and employment gaps.

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It has been relatively easy to reconcile this part of the data set with the second part (1980-2000), as we have had to adjust the data set only for the change in the year base.

Our data set is also partially included in the REGIO data set (EUROSTAT 2004), which provides economic data for the European Regions at different territorial levels, i.e., NUTS (Nomenclature of territorial units for statistics). In particular, our data corresponds to NIPA data provided by Eurostat at the NUTS2 level.

We present estimates based on an Error Correction Mechanism (ECM) specification in order to take short-term dynamics into account and to incorporate long-run relationships, thus taking account of the debate and suggestions derived from the recent development in econometric techniques. Nevertheless, we are aware of the fact that such an estimation technique may give unsatisfactory estimates of the short-run dynamics when using annual data and a data set with a short time domain.

It is worth noting that in our estimates the values of variables for the Italian economy are net of Lombardy's value, in order to derive a more precise description of the effect of exogenous shocks on the rest of the national economy, which thus excludes Lombardy.

- **Labour demand**

Labour demand in industry highlights an adjustment process which is affected by labour hoarding in both the regional and national specifications. Indeed, short-run dynamics of employment are mild if not insignificant as in the national specification, except for the short-run impact of the product price change. In the long run the national specification shows a higher elasticity of employment to value added, when compared to Lombardy. The effect of labour cost is only significant at the national level, and product price in this specification, is significant at a higher significance level (0.23).

On the whole, labour hoarding does affect labour demand in industry in both frameworks; however, in our specification labour hoarding is also captured by the impact of the ratio of labour productivity to total factor productivity. This variable has a greater impact at the regional level, as compared with the national level[7].

This may be explained in terms of the efficiency and competitiveness of the industrial sector in Lombardy, as compared with the rest of the economy.

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Lombardy specialises in both traditional and innovative sectors which in all cases show a larger average firm size in the regional industries as compared with the corresponding size in the national economy[8].

This fact implies that firms in Lombardy are relatively more efficient, showing a high propensity to export and, therefore, a high degree of competitiveness on international markets. Indeed, firms which compete internationally need to adjust quickly to new market conditions.

Although larger firms typically face higher adjustment costs than small firms, as their internal labour market may be affected by insider bargaining power, this pattern prevailed only until the end of the '70s, while in the following two decades union power decreased steadily. This fact permitted the restructuring of manufacturing in Lombardy and a constant shift of employment from industry to services. This may explain the higher responsiveness of employment in Lombardy to labour utilisation, implying that labour hoarding does affect employment in industry in the national more than in the regional labour market.

Labour demand in tradable services, as in the case of employees in industry, shows a differentiated response in the two territorial dimensions to fluctuations in output, factor cost and product price. The response of employment to value added change is significant and higher, in the short-run, at the national level than in Lombardy. This is confirmed in the long –run, as the elasticity of employment to value added is almost one (0.995) in the national specification, and 0.610 at the regional level. Labour cost is significant only in the long run in both specifications, although at the regional level the significance level is higher (0.204) than those conventionally used. This consideration also applies to the product price variable, which shows, as expected, a positive impact on employment.

These results may crucially depend on the characteristics of private services in Lombardy compared to those prevailing at the national level, influenced by the characteristics prevailing in services in the central and southern regions. Indeed, the size of such activities is particularly small in such areas, and thus labour cost becomes a constraint on expansion. This is less relevant in Lombardy, where businesses are on average bigger, thus contributing to absorbing labour cost variations.

Labour hoarding in this sector may be, however, crucially affected by the size of firms and by insider bargaining power. The adjustment process of employment in

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insurance, credit and banking and other financial services, which are sectors in which Lombardy specialises, is crucially affected by internal labour markets and union power[9]. In addition, these sectors have not yet experienced the typical international competition experienced by manufacturing, and so firms have not been stimulated to become more efficient and thus adjust employment to the new market condition.

This argument may explain the long-run impact of labour productivity on employment, thus suggesting that labour hoarding is more relevant in Lombardy than in the Italian services sector[10].

INSERT TABLES 4 AND 5 ABOUT HERE

- **Labour supply**

Labour supply is described by means of the participation rate and self-employment. The estimation of the participation rate shows short-run and long-run relationships which underline how the discouragement effect in the regional equation, as measured by the link between employment and labour force participation, is milder than in the national equation. This result is coherent with the fact that the discouragement effect prevails in the national labour market and therefore the response of the labour force participation rate to changes in economic conditions, proxied by changes in employment, is higher in this context, and determines a quick adjustment in the participation rate. In addition, we include a migration variable to take the impact of inflows of immigrants on the participation rate into account. This impact is not significant, and it may depend on the fact that inflows from foreign countries have increased over the last ten years, therefore affecting only the last part of the sample period. However, it is worth including this variable as it will become ever more important in the future, as immigration, even though restricted at the national and regional level, is an important key to resolving differences between labour demand and supply in some industrial sectors of the Italian and regional economy.

The classical component of labour supply is modelled by using self-employment as a dependent variable. Therefore, we include per-capita nominal earnings as a regressor to take the effect of a change in earned income on individual labour supply into account, as in the typical neoclassical story. In addition, we include the ratio of young unemployed

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persons to total unemployed persons in order to take the marginal component of self-employment into account, i.e., those individuals who react to failure in finding a job as employees[11]. The earning variable is significant only in the long run, and the proportion of young unemployed people affects both the national and regional specification; however, in the former its effect is also significant in the short-run[12].

The effect of human capital in this context is controversial because there are at least two main issues to take into account. The first is a measurement issue, in that human capital, defined as the whole set of knowledge attached to the labour input, cannot easily be measured. Education attainment is typically used as a proxy of human capital, although it is well known that it is only a component of the individual stock of knowledge, which is also acquired on the job (specific human capital). The second issue deals with the distribution of the human capital stock, as measured by the labour force education attainment in the Italian labour market, which is characterised by significant regional differentials in the unemployment rate.

This distribution does not, however, imply an absolute disadvantage of the less developed areas (e.g. southern Italy), as compared with Lombardy. Indeed, the share **of** the labour force with university degree is about 11% in both the regional and national labour markets according to the latest Census Data[13].

The higher impact of the unemployment variable in the national labour supply equation may be explained both in terms of a marginal unskilled labour force seeking job opportunities, and in terms of highly educated labour forces which find it difficult to match their personal characteristics with the jobs available on the labour market. In other words, the non-marginal component of self employment is more relevant in Lombardy as compared with the rest of the country, and this may be explained, as we have previously emphasised, in terms of better job opportunities arising from industries characterised by larger firm size.

It is worthwhile to note that the long-run elasticity of the earning variable is about 0.15 in Lombardy, while it is less than 0.05 in Italy; in addition, the long-run elasticity of the proportion of young unemployed people in Italy is more than three times as high as the elasticity calculated for Lombardy.

These results underline the different characteristics of self employment between Lombardy and the rest of the country, as in the former there is a consistent neo-classical

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component, which is therefore sensitive to changes in opportunity costs, i.e., earnings. In the latter, self-employment responds more to unfavourable labour market conditions, i.e., high unemployment, and this highlights the structural difference of labour supply between the two territorial areas.

INSERT TABLES 6 AND 7 ABOUT HERE

As compared with other regional models, we can argue that our demand side specification is consistent with earlier models (e.g., ADAMS, BROOKING and GLICKMAN 1974), in that sectoral labour demand is derived by assuming sectoral production functions under conditions of profit maximisation. In this model of the Mississippi economy, however, labour supply is exogenous and unemployment is derived from an equation which incorporates the state demographic change, the change in the US unemployment rate, the past state unemployment rate, and the change in state employment.

In MINFORD, STONEY, RILEY and WEBB (1994) a supply-side model of the Merseyside area is set up by defining employment in manufacturing, employment in non-manufacturing sectors, the wage rate, consumption expenditure, manufacturing and non-manufacturing GDP, the working population and the unemployment rate.

Employment in manufacturing is determined by real earnings, unemployment benefits and a time trend which proxies time-dependent factors due to migration or demographic factors. Earnings of all workers crucially depend on manufacturing wages, whereas the working population responds to employment in manufacturing. Thus unemployment derives from the difference between the working age population and total employment.

In a modified version of such a model MINFORD and RILEY (1995) and then HUNT and SNELL (1997) use local output instead of manufacturing employment and the lagged dependent variable term in the working age population equation.

This equation recalls our specification of the participation rate, although we explicitly take account of the separate effect of employees and self-employment on the working population, and the adjustment process is captured by short-run and long- run dynamics by means of the ECM representation.

These earlier approaches to regional modelling highlight the distinctive feature of our labour market model, in which both the demand and supply side are specified, and their interaction determines the unemployment level.

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5. Simulation

The model has been simulated from 1985 to 2000 by means of dynamic deterministic simulation. In Appendix 2 we report the figures with actual and simulated series together with the usual statistics (RMSE, Theil's inequality coefficient, Mincer-Zarnowitz's test)[14]. The overall performance of the simulated model is good, according to the previously-mentioned statistics, and thus the baseline solution is a good benchmark for evaluating the response of the models to exogenous shocks.

It is worthwhile to underline the fact that this is a dynamic simulation, and thus it implies that forecasting errors are cumulated through time. This issue is particularly relevant in our case, as we use an error correction specification which needs an endogenous variable lag structure in each equation. This consideration may explain some specific results of the simulation exercise which, although satisfactory on the whole, presents in some case a less satisfactory performance.

This is the case of self-employment and the participation rate, particularly in the national simulation. This result is, however, not surprising given the estimated equations, as the fit is less satisfactory than in the other estimated equations. In addition, we cannot reject the hypothesis of heteroschedastic errors, and this may depend on the dynamic adjustment process, which is significant only for higher significance levels.

We consider both demand and supply shocks; the former directly affect the level of activity which is approximated by sectoral value added, whereas the latter affects the level of activity by changing relative prices. Thus demand shocks are captured by exogenous changes in value added in industry and tradable services, which in turn are related to the corresponding levels of final demand, and supply shocks are described by changing labour cost and product price. Finally we consider the effect of productivity shocks.

For all shocks, each variable has been changed one at a time by a 1% variation, which has been held constant (in absolute terms) over the whole simulation sample[15].

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- **Value added shocks**

A unit value added increase in industry (VAIND) increases sectoral employment (EEIND) and the total number of employees (EE). This response is higher in the national labour market than in the regional one, and after three time periods it declines over time.

It has to be underlined that these multipliers reflect a crucial assumption, i.e. the *ceteris paribus* condition. In other words, one analyses the impact of each shock assuming that all else remains equal. This is a necessary assumption in order to highlight and discuss the role of each variable in the determination of the endogenous variables under observation. It is clear, however, that in reality more than one variable changes over time, and the impact on the endogenous variables depends on the combination of different effects. In this case the overall impact would be obtained by taking into account the impact of labour cost, prices, and total factor productivity on employees in industry. In the following sections all these arguments will be analysed.

The impact on the participation rate is higher in the national labour market, as is expected from the estimated labour supply equation which shows a higher discouragement effect in this labour market as compared with the regional one. This implies that unemployment declines more in the latter, while in the national labour market it remains almost steady over the entire simulation horizon. Self-employment shows higher multipliers in Lombardy, due to the increase in earnings; this, in turns, permits the narrowing of the overall impact of a value added shock in industry on total employment in both the regional and national labour markets.

The impact of a shock in tradable services value added follows the same pattern described for the industrial value added shock. The difference of the impact on labour supply between Lombardy and the rest of the economy is higher as compared with the shock in value added in industry, but this is offset by a higher impact on self-employment, which implies that the effect on unemployment is similar to that determined by the shock in industry.

The same kind of argument can be applied to the agriculture value added shock, which, however, shows (as expected) multipliers which are very low in absolute terms and relative to those for industry or service value added shocks.

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- **Labour cost and product price shocks**

We first consider a unit rise in money wages in industry, and a corresponding increase in product price. Employment effects are higher in the regional economy, as the direct effect on employees in industry implies a positive net effect in Lombardy, contrary to the national net effect which is milder and then negative. This is the result of the stronger negative effect of the labour cost on labour demand in the national specification. The impact on the participation rate is higher in the regional labour market as employment response is larger. The net effect on unemployment is confined to the short-run in Lombardy, whereas in the rest of the country unemployment remains steady, as the response of the participation rate in Italy is very weak and negative in the short-run, and almost zero in the long-run

The same argument may be applied to the analysis of a unit increase in labour cost and product price in services. In this case the negative effect on unemployment, although mild, does persist in Lombardy, and the unemployment response in the rest of Italy is close to zero along the entire simulation period.

- **Productivity shocks**

Total factor and labour productivity are combined in our specifications to take account of employment adjustment caused by change in labour utilisation, and thus to capture labour hoarding in the regional and national labour market[16]**.** A unit shock in the ratio of labour to total factor productivity in industry determines a higher negative effect on employment on the whole in the regional labour market as compared with the national one; in the long run this gap decreases, although it does not disappear.

This pattern implies that the effect of a productivity shock on unemployment is higher in Lombardy, and this is also increased by the effect on labour supply. Indeed**,** the participation rate declines more in the national labour market as the discouragement effect, brought about by the employment decrease, is higher in this context.

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The same argument may be used for the corresponding productivity shock in services, although the overall effects on employment and unemployment are milder than in the previous case.

6. Conclusions

We have investigated the characteristics of labour demand and supply by using a regional econometric model of Lombardy. We have compared the performance of such a model in the regional and national context by adopting a specification which allows for the endogeneity of both demand and supply of labour. The labour force participation rate and self-employment are the two components of labour supply, whereas labour demand is determined by the equations that define employees in industry and in private services, thus taking as given employees in agriculture, construction and in the public sector.

This specification allows us to estimate and then solve the model, in order to highlight the specific characteristics of the regional labour market, and therefore, the different responses to various exogenous shocks.

It should be underlined that the employment short-run and long-run multipliers are not negligible in either the regional or the national specifications for the industrial sector and services. This fact also suggests that our measure of employees, i.e., full time equivalent labour units, is more appropriate than that used in earlier models in which labour demand was specified in terms of hours worked, and the number of employees was derived through the estimate of hours per worker. This approach could not completely take into account the labour hoarding effect determined by hours spent within the Wage Supplementation Fund scheme (WSF, *Cassa Integrazione Guadagni)* which allows workers to remain employed (instead of being laid off) when firms were restructuring their plants, particularly during recessions.

In addition, employment responsiveness may also be affected by labour legislation, although new laws regarding job contracts and the hiring/firing setting were introduced into the Italian labour market only in the late '90s.

The regional labour market, in comparison with the national one, shows a higher responsiveness of unemployment to demand shocks. This result is mainly due to the low discouragement effect estimated for Lombardy in the participation rate equation. On the supply side, labour cost and price shocks affect the demand and supply for labour and

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therefore unemployment; this latter increases more in Italy than in Lombardy through the same kind of transmission mechanisms previously highlighted, i.e., the milder discouragement effect prevailing in Lombardy's labour supply. Productivity shocks may have mild effects on unemployment, both at the regional and the national level in the shorter run.

It has to be underlined that, although Lombardy has experienced a significant decline in employment in industry and a corresponding increase in employment in services, employment multipliers, which in turn affect unemployment, are higher in the former sector than in the latter.

This evidence has important implications for a region like Lombardy which aims at competing internationally in the most advanced industries. Thus policy aiming at increasing employment in industry –partly as a result of applying new labour law legislation - is crucial for stimulating the labour market and guaranteeing a growth path compatible with a frictional level of unemployment.

Finally, it should be emphasised that the model we have described may be used to outline future research in the field of regional modelling in the European framework. For example the model could be used to analyse the response of different European regions (e.g., the NUTS2 regions as defined by Eurostat) to world demand, price shocks and other possible disturbances.

The empirical methodology may also be improved upon by using a panel vector error correction specification and by analysing regional impulse response functions. This analysis, which is a complement of the more general macro models typically used by government and other institutions, may eventually be used to highlight the dynamic process of the variables under investigation and their differentiate behaviour in the many European regions.

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NOTES

1 We decided to leave the agriculture sector as being exogenous, as our data set does not enable us to specify a well defined demand for labour in agriculture, due to lack of relevant data on seasonal employment and fixed capital. This latter is particularly relevant, as the capital to labour ratio has significantly increased in agriculture over the last decades, and thus technological change explain almost all the long-run dynamics of labour demand in agriculture.

2 This approach has also been used in FIORITO et. Al. (2000) for estimating a quarterly national econometric model.

3 See for example VECCHI (2000) for an empirical analysis applied to the US and Japanese economies.

4 See for example FELICES (2003) for an application to the UK economy.

5 We have not included migration within Italy, as this phenomenon was significant only from the '50s to the early '70s. Since then internal migration has remained substantially steady and thus its inclusion in our regression (which covers the period 1970-2000) cannot be justified.

6 SVIMEZ is the "Italian Association for the Development of Southern Italy"; it is a non- profit organisation established in 1946 whose primary task is the analysis of southern Italy's economic situation, in order to present policy actions aimed at stimulating industrial activities.

7 In the estimated equation for the Italian economy the hypothesis of heteroskedastic errors cannot be rejected. This fact may depend on the coefficients of the short-run dynamics, which are almost insignificant in this equation, thus affecting the variance of the error term.

8 In particular, by looking at the distribution of employment by industries according to the latest figures of the 2001 Industrial Census and using the two-digit ISIC classification, one finds that Lombardy specialises in the following industries; Textile (1.41), Printing and Publishing (1.21), Chemicals (2.0), Rubber and Plastic (1.36), Basic Metal Industries (1.92), Metal Products (1.13), Machinery and Equipment (1.11), Office and Computing Machinery (1.20), Electrical Machines (1.41), Radio TV and Communications Equipment (1.49). The figure in brackets give the ratio of the employment share of each industrial sector in Lombardy to the corresponding share in Italy. Firms size is significantly higher in these sectors in Lombardy as compared with Italy. The average firm size (in terms of employees per firm) in every specialised sector in Lombardy takes the following values (Lombardy, first figure; Italy, second figure); Textile (16.8; 10.5), Printing and Publishing (8.4; 6.5), Chemicals (56.5; 35), Rubber and Plastic (16.9; 16.3), Basic Metal Industries (52.3; 41.7), Metal Products (8.3; 7.3), Machinery and Equipment (15.1;14.3), Office and Computing Machinery (19.4;11.9), Electrical Machines (14.4; 11.4), Radio TV and Communications Equipment (21.6;12.2).

9 The ratio of the employment share of these sectors in Lombardy to the corresponding share in Italy is about 1.24 according to the latest figures of the 2001 Industrial Census.

10 The argument used to justify heteroskedastic errors in the industry equation for Italy may also be applied here to justify heteroskedasticity in the services equation for the Lombardy economy.

11 We have also experimented a specification which included the unemployment rate, together with the young persons component of unemployment. However, this variable did not enter the estimated equation significantly and thus we have decided to include only the young unemployed variable.

12 The White test for heteroskedasticity does suggest that the dynamic adjustment process is probably incomplete; however, it should be underlined that with annual data and a small sample size it is somewhat complicated to specify such an equation dynamically.

13 In order to analyse the impact of human capital more precisely one should use a micro approach (i.e. individual data) instead of a macro approach. Thus, in our case we are constrained by the nature of our model, and so by our data set, to accept these limitations.

14 The Mincer-Zarnowitz test (MINCER and ZARNOWITZ (1969)) refers to the regression of the effective values of an endogenous variable with the fitted values from the estimated regression. Thus, by using standard t-statistics, one can test for the value of the constant as being equal to zero, and the coefficient of the regression line as being equal to one.

15 See GOLDBERGER (1964)

16 See Appendix 3 for the definition of total factor and labour productivity

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Table 1 Economic indicators: ratio of Lombardy to Italy

	GDP/POP	GDP/TE	VAIND/EIND	VASER/ESER	VAAGR/EAGR
1970	1.41	1.16	1.01	3.67	1.42
1975	1.36	1.15	1.02	3.33	1.47
1980	1.34	1.15	1.03	3.20	1.45
1985	1.34	1.17	1.05	2.61	1.36
1990	1.34	1.15	1.07	2.43	1.38
1995	1.33	1.13	1.10	2.21	1.38
2000	1.32	1.14	1.12	2.04	1.41

Source: Calculation based on ISTAT, National Accounts 1980-2000, and SVIMEZ, Regional Accounts for the period 1970-1980. Legend: POP=Population, TE=Total employment (labour units), VAIND=Value added in industry, VASER= Value added in tradable services, VAAGR= value added in agriculture, EIND =Total employment, industry (labour units), ESER =Total employment, services (labour units), EAGR = Total employment, agriculture (labour units).

Table 2 Regional and national economic indicators (Average Annual Growth Rates)

	Lombardy		Italy		Lombardy		Italy		Lombardy			Italy		
	1970-80	*1976-80*	*1970-80*	*1976-80*	*1980-90*	*1986-90*	*1980-90*	*1986-90*	*1990-2000*	*1991-95*	*1996-2000*	*1990-2000*	*1991-95*	*1996-2000*
GDP/POP	2.70	3.00	3.33	4.22	2.24	3.18	2.66	3.73	1.13	1.15	1.51	1.25	0.96	1.49
GDP/TE	2.54	2.22	2.82	3.28	1.74	2.10	2.11	2.78	1.39	2.25	1.15	1.43	2.37	0.71
VAIND/EIND	4.40	4.85	3.86	3.91	3.95	4.07	3.36	3.27	2.53	4.02	1.75	2.12	3.57	1.47
VASER/ESER	1.53	2.10	3.26	2.84	0.69	1.39	3.35	3.01	0.73	1.72	0.85	2.78	3.41	2.41
FIXED INV.	1.90	4.00	1.68	3.77	1.57	5.68	1.55	4.71	1.8	-0.51	3.92	1.39	-2.05	4.43
TFP *INDUSTRY*	3.23	4.25	3.14	3.72	2.64	3.42	2.30	2.69	1.43	2.88	0.9	1.3	2.62	0.93
TFP *SERVICES*	0.70	1.39	1.04	1.55	0.70	1.00	0.30	1.47	0.37	0.69	0.94	0.6	1.23	0.65
LC *INDUSTRY*	16.62	15.34	17.9	16.9	9.34	8.46	9.88	8.68	2.5	2.01	1.92	2.96	2.12	2.36
LC *SERVICES*	18.19	18.65	18.7	19.4	13.13	9.26	12.53	9.16	4.99	3.61	4.68	5.2	4.05	4.62
DEF *INDUSTRY*	12.87	13.15	13.1	13.7	7.73	3.58	7.96	3.67	2.44	3.01	1.32	2.44	2.9	1.2
DEF *SERVICES*	14.84	16.25	14.5	16.1	10.21	5.98	10.30	5.88	4.24	4.59	2.49	3.93	4.49	1.94
DEF GDP	14.29	15.88	14.1	15.3	9.67	5.86	9.26	5.46	3.46	3.77	1.87	3.55	3.85	2.18
EEIND	-0.24	-0.76	1.16	0.84	-2.15	0.51	-1.48	0.69	-1.67	-2.56	-0.29	-0.8	-1.74	0.51
EESER	2.19	1.74	2.5	2.18	2.83	1.67	2.85	1.68	1.07	-0.62	2.25	1.62	-0.05	2.8

Source: Calculation based on ISTAT, National Accounts 1980-2000, and SVIMEZ, Regional Accounts for the period 1970-1980
Legend: POP=Population, TE=Total employment (labour units), VAIND=Value added in industry, VASER= Value added in tradable services, VAAGR= Value added in agriculture, FIXED INV =Fixed Investment, TFP= Total Factor Productivity, LC = Labour cost, DEF = Deflator, EEIND =Employees in industry (labour units), EESER =Employees in services (labour units), EIND =Total employment, industry (labour units), ESER =Total employment, services (labour units).

Table 3 Labour market indicators

	Participation rate		Unemployment rate		Employment rate	
	Lombardy	Italy	Lombardy	Italy	Lombardy	Italy
1970	41.73	38.08	2.97	5.44	45.14	37.18
1975	41.10	37.63	2.76	5.88	44.30	37.28
1980	43.12	39.30	4.52	7.60	45.87	39.10
1985	43.63	40.46	7.71	10.30	45.35	39.54
1990	44.46	42.61	4.05	11.39	48.22	41.34
1995	43.78	39.67	6.17	11.99	46.14	39.32
2000	44.42	40.76	4.37	10.58	47.00	40.62

The participation rate and the employment rate are calculated over the total population
Source: ISTAT- Labour Force Surveys, various yea

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Table 4 - Labour Demand - Employees in Industry - OLS Estimates
Dependent Variable: Δlog(EEIND)

	Lombardy	Italy
$\Delta\log(EEIND)_{t-1}$	0.244**	0.055
	(1.754)	(0.466)
$\Delta\log(VAIND)_{t-1}$	-0.113	-0.029
	(-1.236)	(-0.461)
$\Delta\log(WIND)_t$	-0.189	-0.111
	(-1.244)	(-0.962)
$\Delta\log(DEFIND)_t$	0.326*	0.218*
	(2.356)	(2.433)
$\log(EEIND)_{t-1}$	-0.576*	-0.439
	(-5.440)	(-0.627)
$\log(VAIND)_t$	0.315*	0.411*
	(3.979)	(7.295)
$\log(WIND)_t$	-0.075	-0.138**
	(-0.715)	(-1.883)
$\log(DEFIND)_t$	0.055	0.086
	(0.530)	(1.236)
LH_t	-0.308*	-0.172*
	(-3.442)	(-2.632)
CONST.	2.028**	-0.200
	(1.848)	(-0.219)
Elasticity		
α (1)	0.546	0.937
β (1)	------	-0.316
γ (1)	------	0.196
δ (1)	-0.535	-0.392
SE/MV (2)	-0.914	-17.947
Adj R^2	0.704	0.816
F-stat	8.390	14.793
LM_1 (3)	0.074	0.031
	(0.788)	(0.863)
LM_4 (3)	1.371	1.515
	(0.291)	(0.248)
LM_W (3)	1.237	9.793
	(0.376)	(0.000)

t-statistics in parenthesis.
(1) Long run elasticity with respect to: VAIND, WIND, DEFIND, LH.
(2) Ratio of standard error of regression to mean value of dependent variable.
(3) Lagrange Multiplier Test for first and fourth order autocorrelation (small sample version) and White test for heteroskedasticity, with associated p-values.
*statistically significant coefficient at the 95% level, two-tailed test.
** statistically significant coefficient at the 90% level, two-tailed test.

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Table 5 - Labour Demand - Employees in Tradable Services - OLS Estimates
Dependent Variable: Δlog(EESER)

	Lombardy	Italy
$\Delta\log(EESER)_{t-1}$	0.182	0.336*
	(0.966)	(2.934)
$\Delta\log(VASER)_t$	-1.197	-0.256
	(-1.115)	(-2.451)
$\log(EESER)_{t-1}$	-0.602*	-0.471*
	(-3.303)	(-5.758)
$\log(VASER)_{t-1}$	0.368*	0.469*
	(2.280)	(5.155)
$\log(WSER)_t$	-0.162	-0.142*
	(-1.310)	(-2.477)
$\log(DEFSER)_t$	0.192	0.119**
	(1.460)	(1.848)
LH_t	-0.094*	-0.086*
	(-3.514)	(-3.572)
CONST.	1.492	-0.847
	(1.555)	(-1.119)
Elasticity		
α (1)	0.610	0.995
β (1)	-0.270	-0.301
γ (1)	0.318	0.254
δ (1)	-0.156	-0.183
SE/MV (2)	0.619	0.312
Adj R^2	0.482	0.693
F-stat.	4.717	10.045
LM_1 (3)	0.028	1.183
	(0.869)	(0.290)
LM_4 (3)	0.523	1.697
	(0.721)	(0.197)
LM_W (3)	3.948	0.505
	(0.007)	(0.893)

t-statistics in parenthesis.
(1) Long run elasticity with respect to : VASER, WSER, DEFSER, LH.
(2) Ratio of standard error of regression to mean value of dependent variable.
(3) Lagrange Multiplier Test for first and fourth order autocorrelation (small sample version) and White test for heteroskedasticity, with associated p-values.
* statistically significant coefficient at the 95% level, two-tailed test.
** statistically significant coefficient at the 90% level, two-tailed test.

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Table 6 - Labour Supply - Participation Rate - OLS Estimates
Dependent Variable: Δlog(LF/POP)

	Lombardy	Italy
$\Delta\log(LF/POP)_{t-1}$	0.156	-0.049
	(1.005)	(-0.491)
$\Delta\log(SE/POP)_t$	0.228*	0.300*
	(3.180)	(2.672)
$\Delta\log(EE/POP)_t$	0.110	0.859*
	(0.872)	(4.676)
$\Delta\log(IMMIG)_t$	0.004	0.008
	(0.444)	(0.950)
$\log(LF/POP)_{t-1}$	-0.655*	-0.885*
	(-2.842)	(-3.955)
$\log(SE/POP)_{t-1}$	0.171*	0.424*
	(2.354)	(4.255)
$\log(EE/POP)_{t-1}$	0.133	0.537*
	(1.014)	(2.744)
$\log(IMMIG)_{t-1}$	0.006	0.009
	(0.737)	(0.841)
DUM93	-0.012	-0.015*
	(-1.680)	(-2.327)
CONST.	-0.039	0.794*
	(-0.245)	(3.727)
Elasticity		
α (1)	0.260	0.480
β (1)	0.203	0.607
SE/MV (2)	2.367	2.718
Adj R^2	0.622	0.812
F-stat.	6.123	14.407
LM_1 (3)	0.459	0.019
	(0.507)	(0.893)
LM_4 (3)	3.550	0.738
	(0.031)	(0.580)
LM_W (3)	1.643	1.788
	(0.203)	(0.165)

t-statistics in parenthesis.
(1) Long run elasticity with respect to : SE/POP, EE/POP.
(2) Ratio of standard error of regression to mean value of dependent variable.
(3) Lagrange Multiplier Test for first and fourth order autocorrelation (small sample version) and White test for heteroskedasticity, with associated p-values.
* statistically significant coefficient at the 95% level, two-tailed test.
** statistically significant coefficient at the 90% level, two-tailed test.

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Table 7 - Labour Supply - Self Employment - OLS Estimates
Dependent Variable: Δlog(SE)

	Lombardy	Italy
$\Delta\log(SE)_{t-1}$	0.163	0.129
	(1.160)	(0.738)
$\Delta\log(PROFSE)_t$	0.002	-0.002
	(0.033)	(-0.018)
$\Delta\log(YU)_t$	0.024	0.106*
	(0.740)	(1.928)
$\log(SE)_{t-1}$	-0.450*	-0.386*
	(-3.809)	(-3.399)
$\log(PROFSE)_{t-1}$	0.066*	0.017*
	(3.505)	(2.401)
$\log(YU)_{t-1}$	0.047*	0.171*
	(2.696)	(3.080)
CONST.	2.980*	3.428*
	(3.856)	(3.404)
Elasticity		
α (1)	0.146	0.044
β (1)	0.104	0.443
SE/MV (2)	1.060	3.514
Adj R^2	0.450	0.371
F-stat.	4.820	3.752
LM_1 (3)	0.027	0.402
	(0.871)	(0.533)
LM_4 (3)	0.953	0.123
	(0.457)	(0.972)
LM_W (3)	1.657	2.719
	(0.171)	(0.032)

t-statistics in parenthesis.
(1) Long run elasticity with respect to : PROFSE, YU .
(2) Ratio of standard error of regression to mean value of dependent variable.
(3) Lagrange Multiplier Test for first and fourth order autocorrelation (small sample version), and White test for heteroskedasticity, with associated p-value.
* statistically significant coefficient at the 95% level, two-tailed test.
** statistically significant coefficient at the 90% level, two-tailed test.

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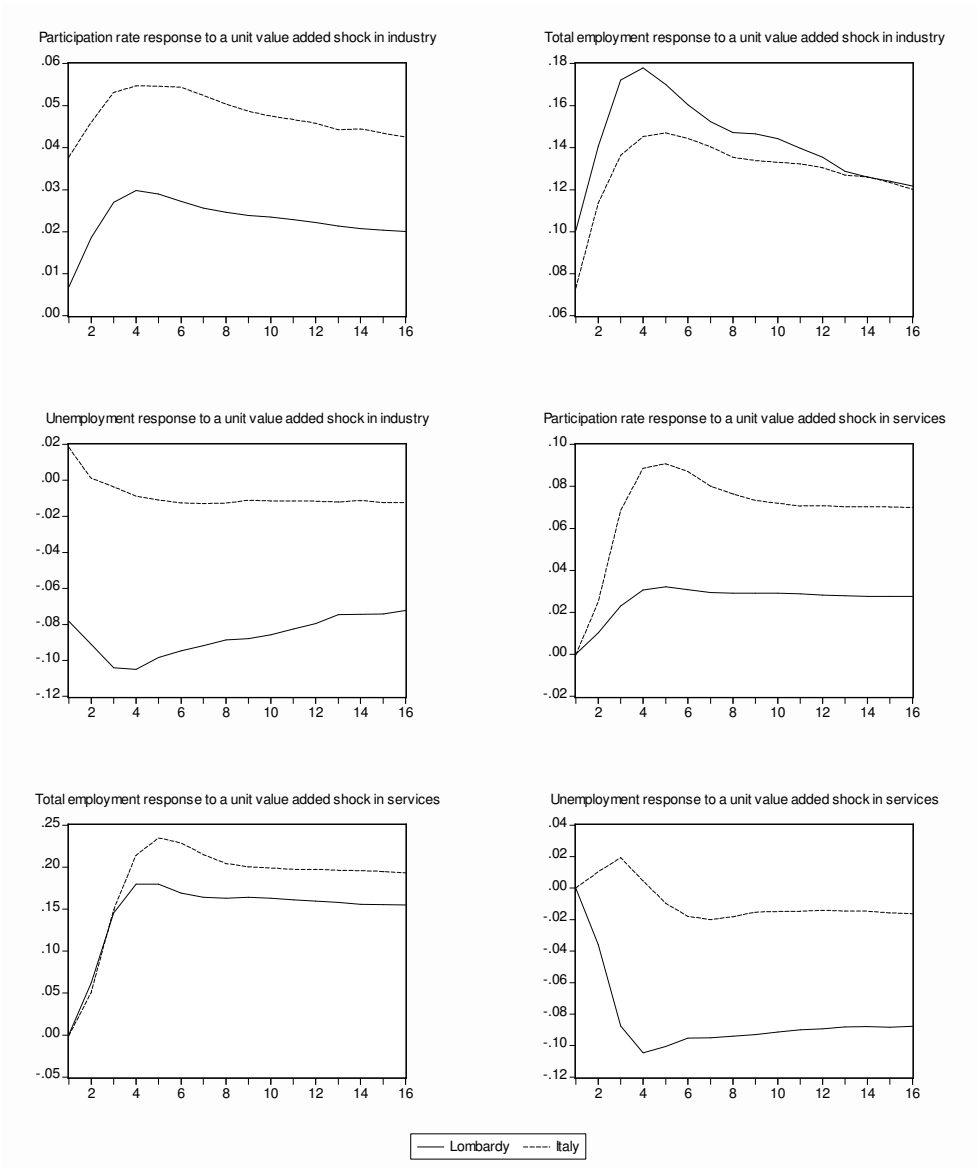
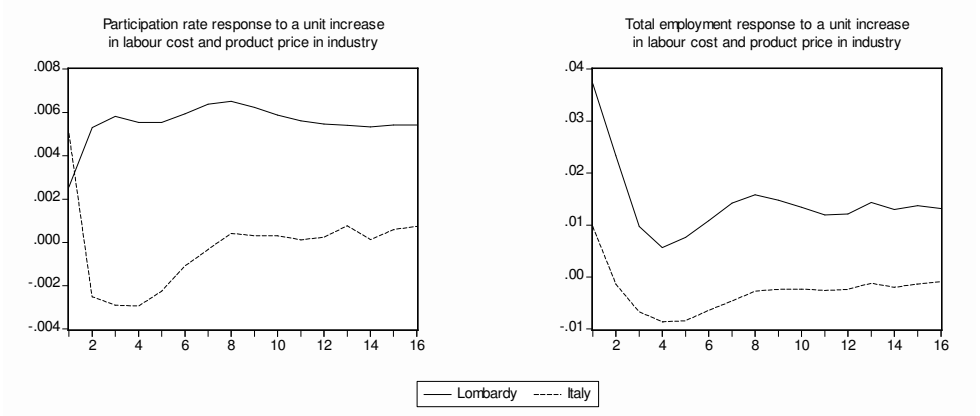
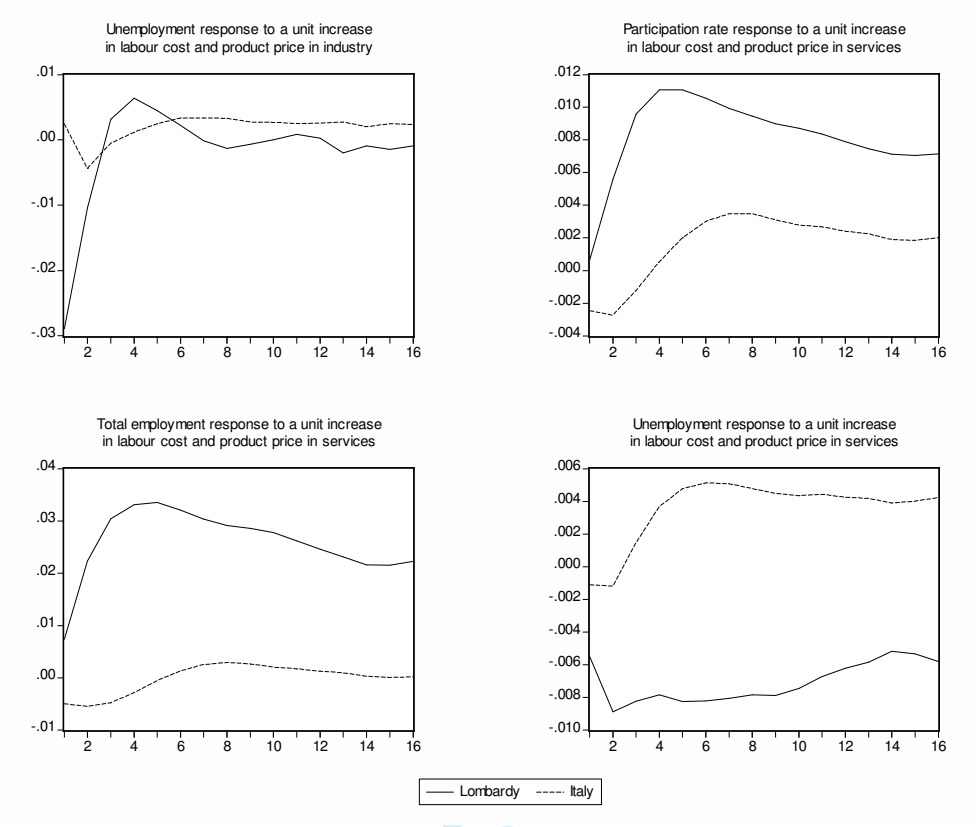
APPENDIX 1

Value added shocks

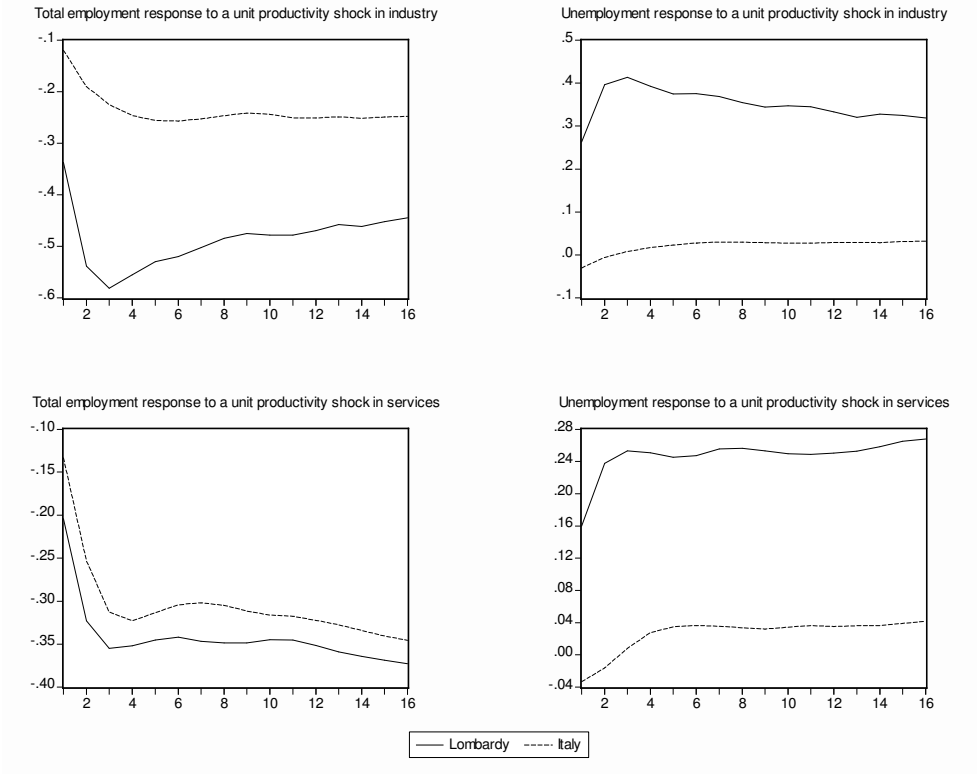


Labour cost and product price shocks



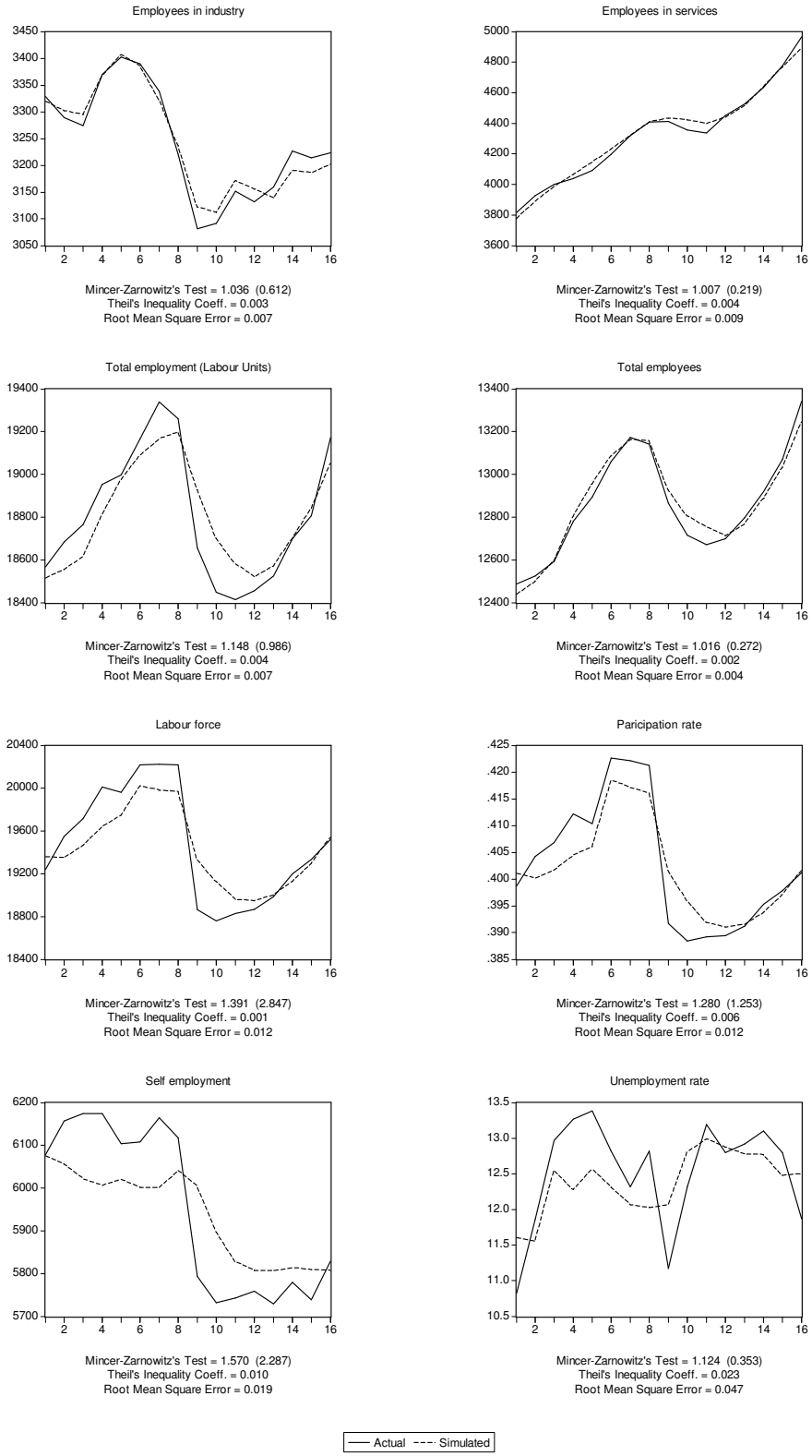


Productivity shocks



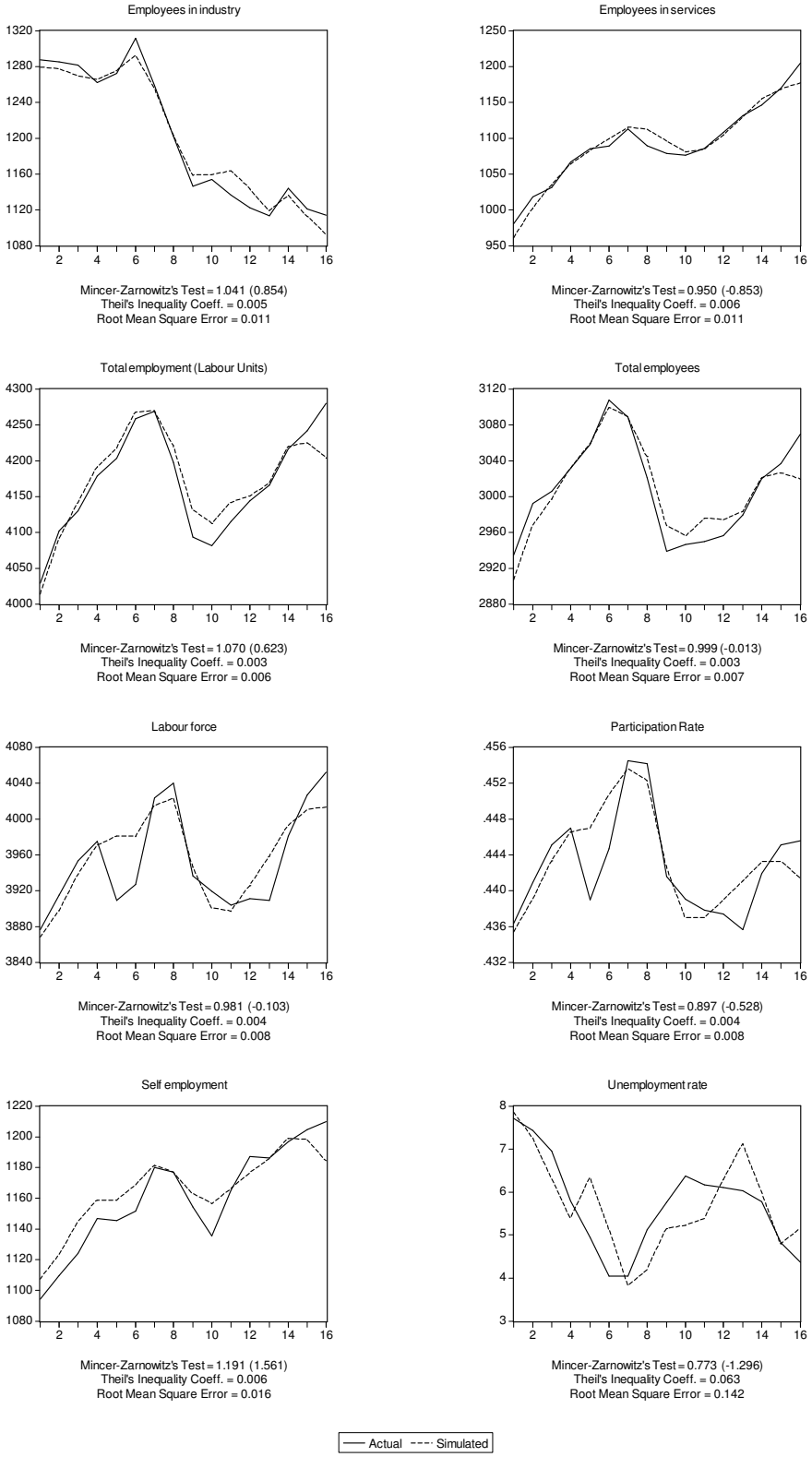
APPENDIX 2

ITALY
Dynamic-deterministic simulation



* The Mincer-Zarnowitz test refers to the coefficient of the regression of actual values on fitted values. In parenthesis we show the corresponding t-statistics relative to the hypothesis that this coefficient is different from 1.

LOMBARDY
Dynamic-deterministic simulation



* The Mincer-Zarnowitz test refers to the coefficient of the regression of actual values on fitted values. In parenthesis we show the corresponding t-statistics relative to the hypothesis that this coefficient is different from 1.

APPENDIX 3 – DATA SOURCES

DEFAGR	**value added deflator in agriculture (1995=100)**	
DEFIND	**value added deflator in industry (1995=100)**	
DEFSER	**value added deflator in tradable services (1995=100)**	
EE	**total employees**	**(NA)**
EEAGR	**employees in agriculture**	**(NA)**
EEIND	**employees in industry**	**(NA)**
EESER	**employees in tradable services**	**(NA)**
IMMIG	**immigration flows from abroad**	**(ID)**
INTAX	**net indirect taxes**	**(NA)**
LF	**labour force**	**(ILF)**
OEE	**other employees**	**(NA)**
PR	**participation rate**	**(ILF)**
PROF	**nominal total profits**	**(NA)**
POP	**population**	**(NA)**
SE	**self employment**	**(ILF)**
TE	**total employment**	**(ILF)**
TEE	**total employment adjusted for discrepancy with total labour units**	**(NA) (ILF)**
TFPIND	**total factor productivity in industry**	**(NA)**
TFPSER	**total factor productivity in tradable services**	**(NA)**
UR	**unemployment rate**	**(ILF)**
VAAGR	**value added in agriculture at 1995 prices**	**(NA)**
VAIND	**value added in industry at 1995 prices**	**(NA)**
VASER	**value added in tradable services at 1995 prices**	**(NA)**
WAGR	**per capita nominal labour cost in agriculture**	**(NA)**
WIND	**per capita nominal labour cost in industry**	**(NA)**
WSER	**per capita nominal labour cost in tradable services**	**(NA)**
YU	**ratio of persons searching a job for the first time to total unemployed**	**(ILF)**

ID = ISTAT, National Demographic Statistics
ILF = ISTAT (Labour Force Survey)
NA = National Accounts (1970-1980, SVIMEZ (1998); 1980-2000 ISTAT(2000))

TFP is defined as: $A = \frac{Y}{K^{\alpha} L^{1-\alpha}}$ **where Y is output and K and L are capital and labour inputs. Labour and income shares are derived from the regional and national accounts, and are taken as long-run average values over the entire sample period.**

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